vertical grids of the lower level; sampling information on height of a target image on a regular basis and allocating the sampled height information to each vertex of the triangular patches included in the multi-level LOD hierarchical mesh; determining an LOD of each triangular patch according to a view point of a virtual camera; and connecting the adjacent triangular patches with each other without gaps when the adjacent triangular patches among the triangular patches of the multi-level LOD hierarchical mesh have different LOD levels.

[0014] According to a further aspect of the present invention, there is provided a computer readable recording medium on which a program is used for implementing a method for representing a multi-level LOD three-dimensional image, the computer readable recording medium including: configuring a multi-level LOD hierarchical mesh for each hierarchical level with a different LOD level by arranging triangular patches of a upper level (level m+1, lower resolution) to have approximately kxk of triangular patches of an lower level (level m, higher resolution), where k is the number of horizontal and vertical grids of the upper hierarchical level; sampling information on height of a target image on a regular basis and allocating the sampled height information to each vertex of the triangular patches included in the multi-level LOD hierarchical mesh; determining an LOD of each triangular patch according to a view point of a virtual camera; and connecting the adjacent triangular patches with each other without gaps when the adjacent triangular patches among the triangular patches of the multi-level LOD hierarchical mesh have different LOD levels.

[0015] It is to be understood that both the foregoing general description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention as claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0016] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings:

[0017] **FIG. 1** is a configuration diagram illustrating an apparatus for representing a multi-level LOD three-dimensional image according to an embodiment of the present invention;

[0018] **FIG. 2** is a diagram illustrating a hierarchical mesh for representing a multi-level LOD terrain using triangular patches according to an embodiment of the present invention;

[0019] **FIG. 3** is a diagram illustrating a hierarchical mesh with an n-level hierarchical structure according to an embodiment of the present invention;

[0020] **FIG. 4** is a diagram illustrating an exemplary arrangement of vertices of the hierarchical mesh with respect to information on height of a regularly sampled target image;

[0021] **FIG. 5** is a diagram illustrating an exemplary LOD distribution of triangular patches when the LOD is determined based on an error of a screen;

[0022] **FIG. 6** is a diagram illustrating an exemplary LOD distribution of triangular patches when the LOD is determined based on a distance from a virtual camera;

[0023] FIGS. **7**(*a*) to **7**(*g*) are diagrams illustrating a method for connecting adjacent patches having different LOD levels without gaps according to an embodiment of the present invention;

[0024] FIGS. **8**(*a*) to **8**(*d*) are diagrams illustrating a method for connecting patches when 2 triangular patches of an higher resolution are arranged adjacent to one selected triangular patch of a lower resolution;

[0025] **FIG. 9** is a diagram illustrating a multi-level LOD terrain represented based on the screen error based LOD according to an embodiment of the present invention;

[0026] **FIG. 10** is a flowchart for describing sequential operations of configuring a multi-level LOD hierarchical mesh having different LOD levels using triangular patches according to an embodiment of the present invention; and

[0027] **FIG. 11** is a flowchart for describing sequential operations of connecting adjacent triangular patches with different LOD levels according to an embodiment of the present invention.

DETAILED DESCRIPTION OF THE INVENTION

[0028] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. It should be noted that like reference numerals denote like elements even in different drawings. When describing the preferred embodiments, detailed description of related known functions or configuration will be omitted if being determined to confuse the main point of the present invention.

[0029] **FIG. 1** is a configuration diagram illustrating an apparatus for representing a three-dimensional image with multi-level LOD (level of detail) in accordance with an embodiment of the present invention.

[0030] The apparatus **10** includes a patch configuration unit **11**, an LOD determination unit **12** and a patch connection unit **13**, and is connected to an input device **20** and a display device **30**.

[0031] The input device **20** provides a target image to be represented on the display device **30** to the apparatus **10**. Although the target image is mainly applied with a vast amount of data such as a terrain model, the target image is not limited to the terrain model; rather, the target image can be any images such as objects and surfaces that can be represented three-dimensionally. For instance, in the case of the terrain model, the target image can use scanned images by satellites or air planes, or a terrain model produced by a user.

[0032] As illustrated in **FIG. 2**, the patch configuration unit **11**, more particularly, triangular patch configuration unit **11** configures a multi-level LOD hierarchical mesh with different LOD levels using triangular patches according to an embodiment of the present invention. Particularly, **FIG. 2** is a diagram illustrating a hierarchical mesh for represent-